

NON-PUBLIC?: N
ACCESSION #: 9111200183
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Waterford Steam Electric Station Unit 3 PAGE: 1 OF 08

DOCKET NUMBER: 05000382

TITLE: Manual Reactor Trip in Response to High Steam Generator Water
Level Due to a Failed Startup Feedwater Regulating Valve
EVENT DATE: 06/24/91 LER #: 91-013-01 REPORT DATE: 11/15/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 025

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(92)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: W. R. Brian, Plant Engineering TELEPHONE: (504) 464-3127
Superintendent

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JB COMPONENT: LC MANUFACTURER: W120
B JI V C600
B SJ TC W120
REPORTABLE NPRDS: Y
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1315 hours on June 24, 1991, the reactor at Waterford Steam Electric Station Unit 3 was manually tripped due to high water level in Steam Generator (SG) #2. Four SG #2 high level reactor pre-trip alarms were received prior to manually initiating a reactor trip. A main steam isolation signal was manually actuated subsequent to the reactor trip as a result of excessive cool down rate. This event is reportable as an unplanned reactor protection system actuation.

The root cause of this event is SG #2 startup feedwater regulating valve

failing open while at approximately 25 percent reactor power. A process analog control (PAC) card in the valve control circuitry failed, resulting in a constant open signal to SG #2 startup feedwater regulating valve. The PAC card was replaced and PAC card performance will be trended as part of the Long Term Reliability Program. Plant protective features functioned as designed; therefore, this event did not threaten the health or safety of the general public or plant personnel.

END OF ABSTRACT

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REPORTABLE OCCURRENCE

At 1315 hours on June 24, 1991, the reactor (EIIS Identifier AB) at Waterford Steam Electric Station Unit 3 was manually tripped due to high water level in Steam Generator (SG) #2 (EIIS Identifier SB). Four SG #2 high level reactor pre-trip alarms were received prior to manually initiating a reactor trip. A main steam isolation signal was manually actuated subsequent to the reactor trip as a result of excessive cool down rate. At 1332 and 1424 hours respectfully, operations personnel manually initiated an emergency feedwater actuation signal (EFAS) (EIIS Identifier JE) to SGs #1 and #2. The EFASs were initiated to restore SG water levels in accordance with OP-902-004. This event is reportable as an unplanned reactor protection system actuation and engineered safety feature actuations.

INITIAL CONDITIONS

Approximately 25% power prior to the reactor trip
Mode 1

EVENT SEQUENCE

At 1119 hours on June 24, 1991, Waterford Steam Electric Station Unit 3 was operating at 100% power, when a grid voltage transient caused by lightning actuated the sudden pressure relay trips on main transformers A and B (EIIS Identifier EA-XFMR). The sudden pressure trips on both main transformers initiated a main turbine generator (EIIS Identifier TA) trip signal. The subsequent load rejection was automatically accommodated by the Steam Bypass Control System (SBCS) (EIIS Identifier JI) and the Reactor Power Cutback System (RPCS) (EIIS Identifier JD). Reactor power stabilized at approximately 35% power with control element assembly (CEA) regulating groups 5 and 6 (EIIS Identifier AA) inserted as a result of the RPC.

Control room indications of the transient were main transformer A and B sudden pressure trip flags, the main turbine tripped, all 6 steam bypass control valves (SBCV) (EIIS Identifier JI-V) initially open and then sequentially shutting to modulate steam demand, and CEA regulating groups 5 and 6 rod bottom lights lit with corresponding plant parameters changing as expected in response to a RPC.

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Off-normal Operating Procedure, OP-901-003, Reactor Power Cutback, was entered. At 1127 hours, reactor power was stable at approximately 35% power. At 1138 hours, withdrawal of CEAs was commenced in accordance with OP-901-003. At 1242 hours, CEA regulating group 6 was greater than 75 inches and OP-901-003 was exited. At 1251 hours, CEA regulating group 6 was greater than 120 inches and Feedwater Pump Turbine (FWPT) 'A' (EIIS Identifier SJ) was secured.

The Shift Supervisor, upon concurrence from the Operations Superintendent, directed that reactor power be lowered to approximately 25% while personnel inspected the main transformers and the switchyard electrical distribution for damage. The inspection was estimated to take several hours.

At 1303 hours, FWPT 'A' recirculation valve, FW-111A, was isolated due to the spurious cycling of this valve. At 1308 hours, the instrument air line for the actuator assembly to SBCV MS-320A was discovered to be broken with the valve failed in the open position. The control room staff ordered SBCV MS-320A to be isolated locally to ensure that the valve shut in a slow controlled manner to minimize any transient on the secondary system.

At 1315 hours, reactor power was 26% and slowly lowering, when the water level for steam SG #2 began to rise at a rapid rate. SG water level control (EIIS Identifier JB) was in automatic. Operations personnel in the control room recognized that SG #2 startup feedwater regulating valve (SUFWRV) (EIIS Identifier SJ-V) had failed open. SG #2 SUFWRV controller was placed in manual and the valve failed to respond. SG #2 high level pre-trips were received on all four channels of the Plant Protection System (PPS) (EIIS Identifier JC). Operations personnel manually tripped the reactor prior to the SG #2 high water level reactor trip setpoint (87.7% narrow range indication). SBCV MS-320A was partially isolated at this time.

A Main Steam Isolation Signal (MSIS) (EIIS Identifier JE) was manually actuated because of excessive reactor coolant system (RCS) cool down at 1317 hours. Subsequently, operations personnel noted during the post

trip review that at 1316 hours, a high SG #2 level wide range instrumentation (96% wide range indication) initiated a main feedwater isolation valve signal to shut FW-184B, main feed water isolation valve (EHS Identifier SJ-V) to SG #2.

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The reactor trip override circuitry provides signals to shut both main feedwater regulating valves and throttles SUFWRVs to approximately 20% open upon initiation of a reactor trip. The throttling of SG #1 SUFWRV increased the feedwater flow rate and the rise in water level for SG #2, since SG #2 SUFWRV was failed open. Ultimately, SG #2 level rose above the high SG #2 level main feedwater isolation valve signal increasing the RCS cooldown rate until the isolation signal occurred.

At 1320 hours, Emergency Operating Procedure OP-902-004, Excess Steam Demand Recovery Procedure, was entered due to MS-320A failing open. At 1324 hours, an Unusual Event was declared as a result of the excessive cool down resulting from SBCV MS-320A and SG #2 SUFWRV failing open. The lowest reactor coolant cold leg temperature reached during the excess steam demand transient was approximately 528 degrees Fahrenheit.

At 1332 hours, operations personnel manually initiated an EFAS to SG #1. At 1424 hours, operations personnel manually initiated an EFAS to SG #2. The EFASs were initiated to restore SG water levels in accordance with OP-902-004.

At 1712 hours, OP-902-004 was exited and Emergency Operating Procedure OP-902-008, Safety Function Recovery Procedure, was entered. At 1718 hours, OP-902-008 was exited. At 1723 hours, the Unusual Event was terminated with plant conditions stable.

Chronology of the Events on June 24, 1991

1119 hours Turbine trip due to main transformer sudden overpressure trip on both transformers. Entered OP-901-003, "Reactor Power Cutback."

1127 hours Reactor power stable at 35% power after the reactor cutback.

1138 hours Commenced withdrawing Regulating Group 4.

1140 hours Commenced withdrawing Regulating Group 5 in manual sequence.

1204 hours Commenced withdrawing Regulating group 6 in manual sequence.

1205 hours Removed reactor cutback from service.

1242 hours Regulating Group 6 > 75 inches. Exited OP-901-003 and

entered OP-010-001, "General Plant Operations."

1251 hours Regulating Group 6 > 120 inches. Secured FWPT "A."

1303 hours Isolated FWPT "A" recirculation valve due to cycling of FWPT "A" recirculation valve.

1308 hours SBCV MS-320A failed open.

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1315 hours SUFWRV # 2 malfunction causes HI LVL in SG # 2. The reactor was manually tripped when all 4 HI LVL pre-trips were received on SG # 2.

1316 hours FW-184B MFIV # 2 shuts on HI LVL isolation at 96% WR SG # 2 level.

1317 hours MSIS manually initiated due to excessive cool down.

1320 hours Entered OP-902-004, "Excess Steam Demand."

1324 hours Declared an Unusual Event

1332 hours Manually initiated EFAS - 1 for feeding SG #1.

1424 hours Manually initiated EFAS - 2 for feeding SG #2.

1712 hours Entered OP-902-008, "Safety Function Recovery Procedure," and exited OP-902-004.

1718 hours Exited OP-902-008.

1719 hours Entered OP-902-001, "Uncomplicated Reactor Trip."

1723 hours Exited the Unusual Event.

1820 hours Exited OP-902-001.

CAUSAL FACTORS

The root cause of this event is failure of the SUFWRV control circuitry to maintain proper water level (60-70% narrow range indication) in SG #2. At 25% power, the SUFWRVs are approximately 75% open. The failure of the SUFWRV control system caused an overfeed transient. The startup feedwater regulating valve failed open due to a malfunctioning Westinghouse Tracking Driver NTD card, FW IHT1106 serial # c66056, in the Process Analog Control (PAC) System. Specifically, a quad two input nand chip failed on the NTD card.

The PAC card failure resulted in a constant open signal to SG #2 startup feedwater regulating valve. The PAC card that failed was a new card with only one month of service time, installed as part of an effort to improve PAC card reliability.

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Contributing to this event was the failure of SBCV MS-320A. The mechanical failure of SBCV MS-320A was possibly a result of the mechanical vibration caused by the inadvertent cycling of FW-111A, FWPT

'A' recirculation valve. The close physical proximity of SBCV MS-320A to FW-111A may have resulted in mechanical vibration of SBCV MS-320A and possibly caused the mechanical feedback position arm to become disconnected, resulting in a constant open signal to SBCV MS-320A. The cause of the material failure of the instrument air line to the actuator assembly for SBCV MS-320A has not been identified. The mechanical feedback position arm has been repaired and the instrument air line has been replaced.

Also contributing to this event was FW-111A spuriously cycling open from the closed position due to a faulty Westinghouse function generator NCH card, CDIFCH2210A serial # 30352. The NCH card provided a spurious open signal to recirculation valve FW-111A.

The design of the main transformer sudden pressure trip contributed to this event. The sudden pressure trip on the main transformer provides redundant protection of the transformer.

Non-Causal Factors

The following factors did not cause the event, but are potential problems that were identified.

- Data point A11108, SG #1 level, inaccurately recorded a constant level during the trip. This data point is part of the post trip processor report.
- The high level alarm setpoint for SG water level is 87.6% narrow range and the reactor trip setpoint is a nominal 87.7% narrow range. The alarm setpoint does not provide any time for operator action to prevent a trip.

CORRECTIVE MEASURES

- The malfunctioning Westinghouse Tracking Driver NTD card, FW IHT1106 serial # c66056, in the Process Analog Control (PAC) System was replaced.
- PAC cards will continue to be trended as part of the Long Term Reliability Program (LTRP) to identify any adverse or common failure of PAC cards and enhance PAC system performance.

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- The SBCV were placed in the LTRP to identify adverse trends and

evaluate the instrument air lines for improvements to prevent material failure of the lines.

- The PAC card for SG #2 startup feedwater regulating valve was replaced.

- Diagnostic testing on FW-111A Westinghouse function generator NCH card, CDIFCH2210A serial # 30352, revealed no faults. The failure of the NCH card was considered to be an isolated occurrence.

- An engineering evaluation was performed and the main transformer sudden pressure trip signal to the main turbine was removed.

- This event will be evaluated by the training department for inclusion as a training scenario by June 30, 1992.

SAFETY SIGNIFICANCE

Plant protective features functioned as designed; therefore, this event had no safety significance and did not threaten the health and safety of the general public or plant personnel.

A generic concern is the reliability of the PAC system and common failures of PAC cards. The concern is being addressed by the LTRP.

There was no major equipment out of service prior to this event that would have effected this event.

SIMILAR EVENTS

LER 90-012 reported a reactor trip following a severe voltage transient on the 230 KV transmission grid (EHS Identifier FK) caused by a lightning strike. The SBCS was inoperable during the event due to grid voltage fluctuations and as a result, the reactor tripped due to the load reduction from the main turbine.

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LER 90-003 reported a reactor trip due to a severe voltage transient on the 230 KV power transmission grid. The transient was initiated when an Occidental Chemical Company employee inadvertently opened a wrong switch and caused the fault on the grid.

Since these two events, a design change has been implemented which

re-aligned the SBCS control power supply to an uninterruptable power supply.

PLANT CONTACT

W. R. Brian, Plant Engineering Superintendent, 504/464-3127

ATTACHMENT 1 TO 9111200183 PAGE 1 OF 1

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Ref. 10CFR50.73(a)(2)(iv)

W3B5-91-0295
A4.05
QA

November 15, 1991

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Submittal of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-91-013-01 for Waterford Steam Electric Station Unit 3. This Licensee Event Report supplement is submitted to provide additional information on corrective action resulting from the investigation of the event described. This Licensee Event Report is submitted pursuant to 10CFR50.73 (a)(2)(iv).

Very truly yours,

D. F. Packer
General Manager - Plant Operations

DFP/LDC/rk
Attachment

cc: Messrs. R. D. Martin
G. L. Florreich
J. T. Wheelock - INPO Records Center
E. L. Blake
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NRC Resident Inspectors Office

*** END OF DOCUMENT ***
